

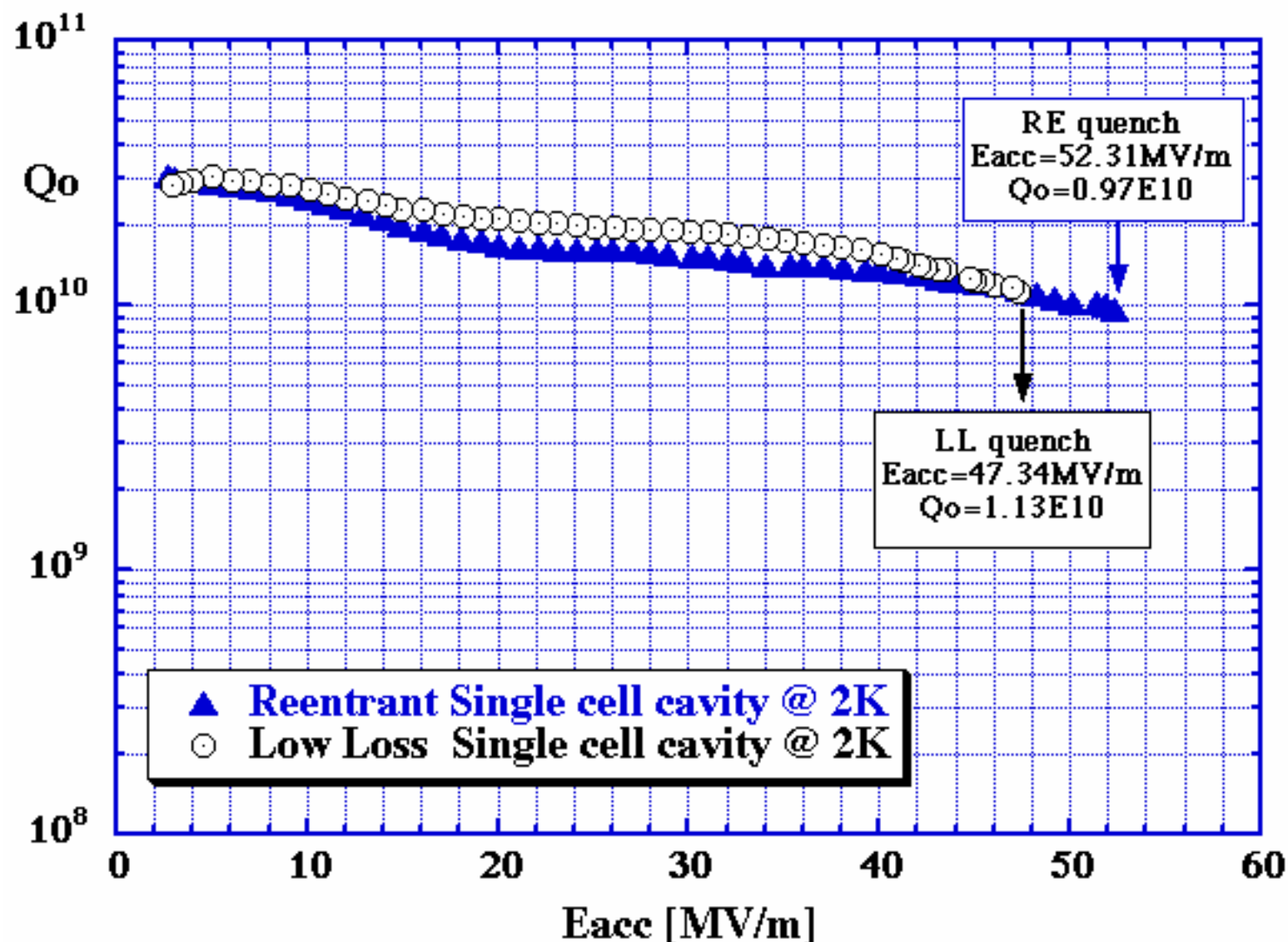
Latest Results of High Gradient Cavities at KEK

SMTF meeting

6 October 2005

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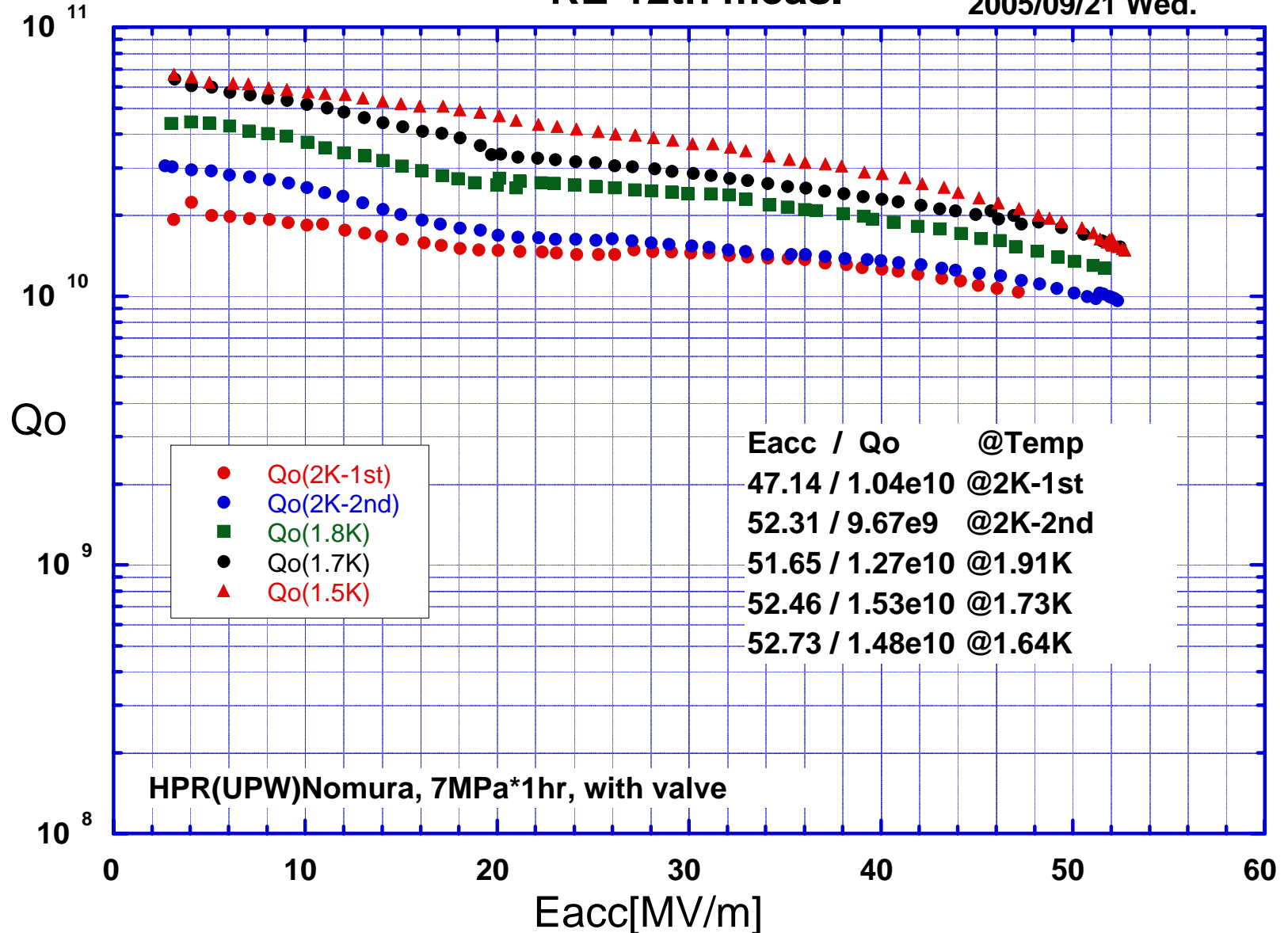
Typical Q_0 vs E_{acc} plot for RE and LL single-cell cavities



RE single-cell cavity VT

RE-12th meas.

2005/09/21 Wed.



Single-cell RE cavity vertical measurements at 2K

EP + HPR	(10th VT)	51.2 MV/m
Re-evacuation	(11 th VT)	48.1 MV/m
HPR	(12 th VT)	52.3 MV/m
Re-evacuation	(13th VT)	51.88 MV/m
Warm-up	(14 th VT)	52.43 MV/m

Average

51.18 MV/m

Std. Dev.

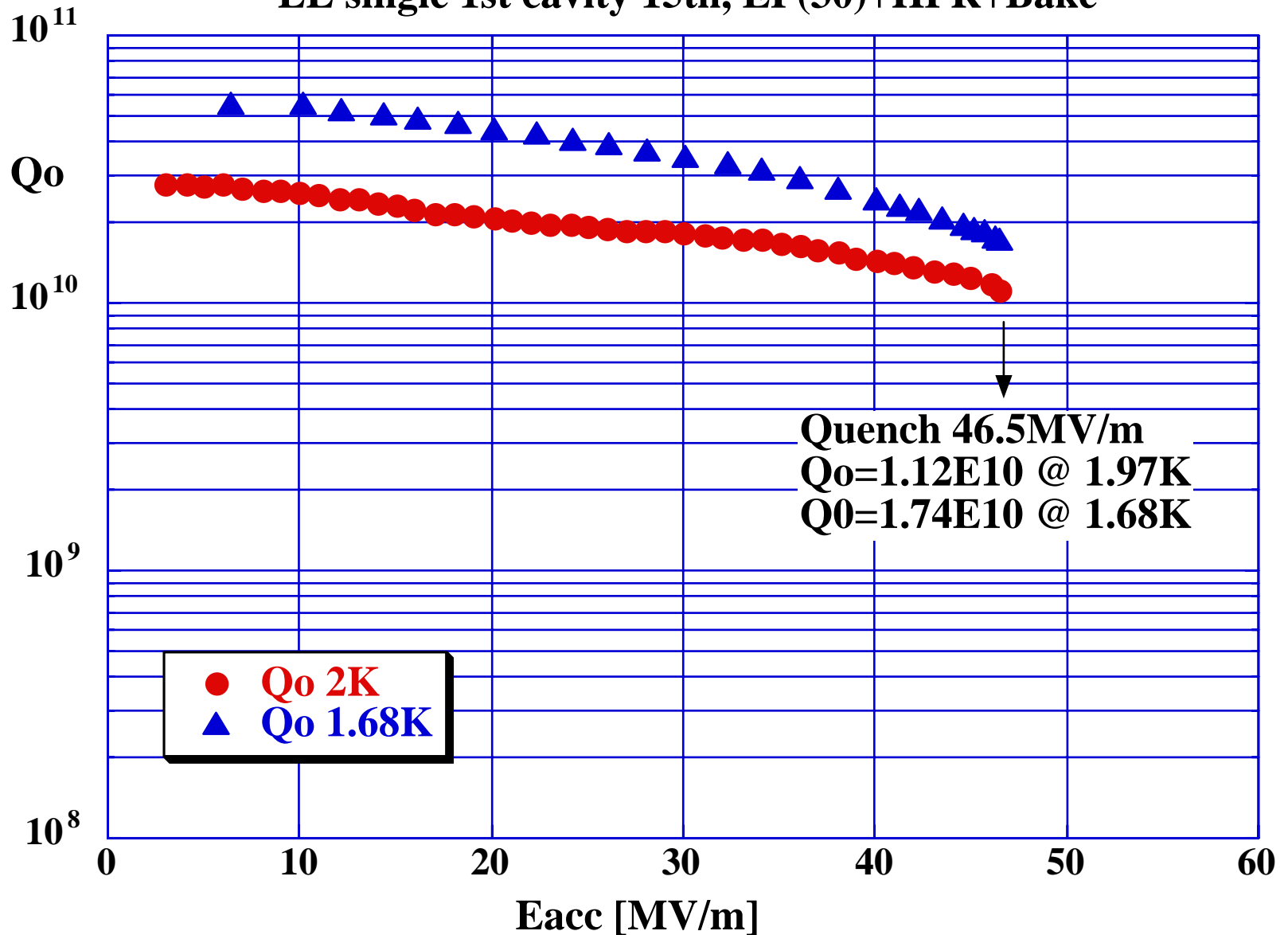
1.79 MV/m

Fabrication: Cornell, Anneal(1400C)

KEK preparation recipe: Mec. Grinding, light-CP(10um),
Anneal(750C), EP(80um), HPR,
Bake(48h,120C)

LL single-cell cavity VT

LL single 1st cavity 15th, EP(30)+HPR+Bake



Single-cell LL cavity vertical measurements at 2K

EP + HPR	(15th VT)	46.45 MV/m
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Re-evacuation	(16 th VT)	47.34 MV/m
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Average	46.80 MV/m
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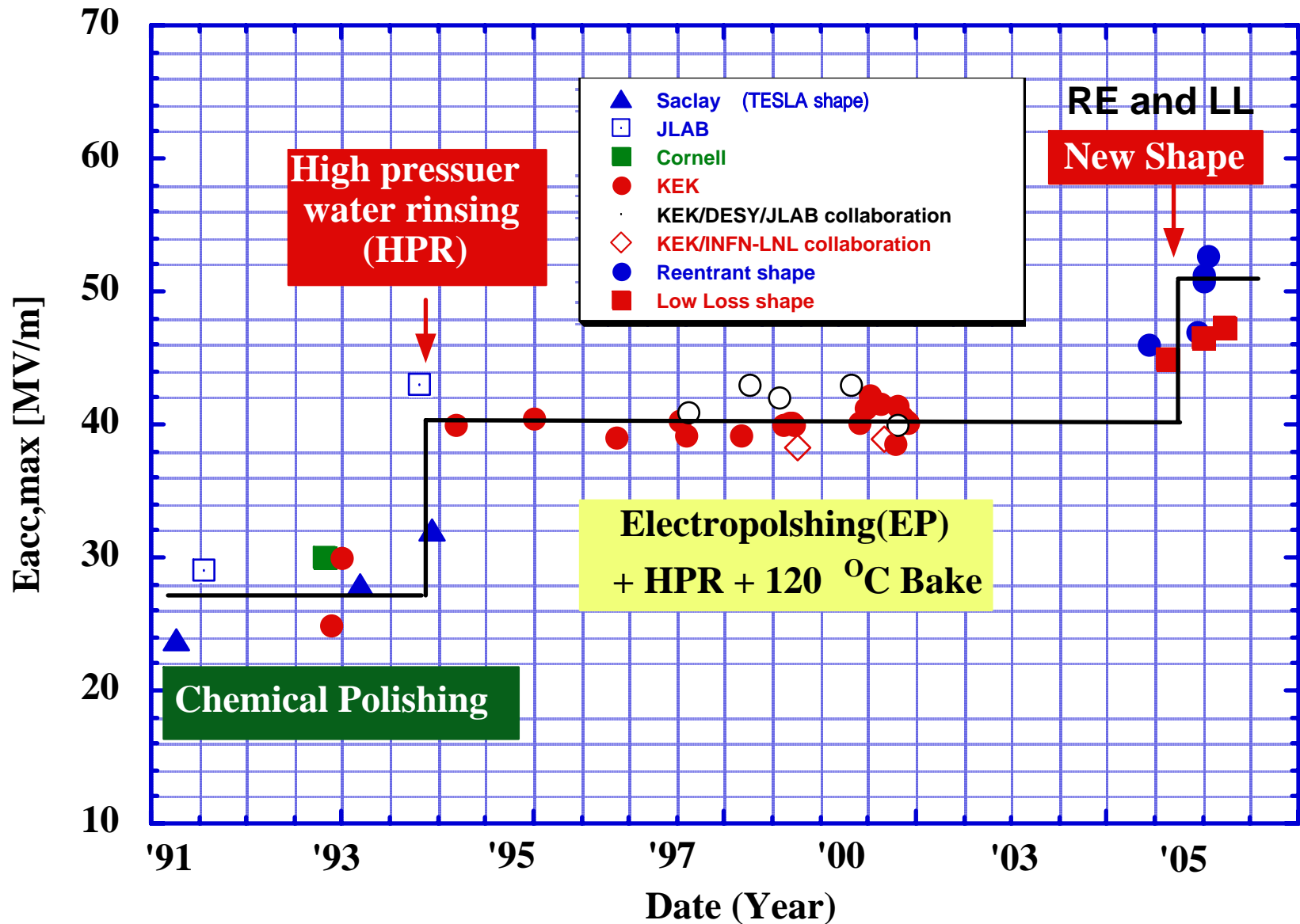
Std. Dev.	0.49 MV/m
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Fabrication: KEK

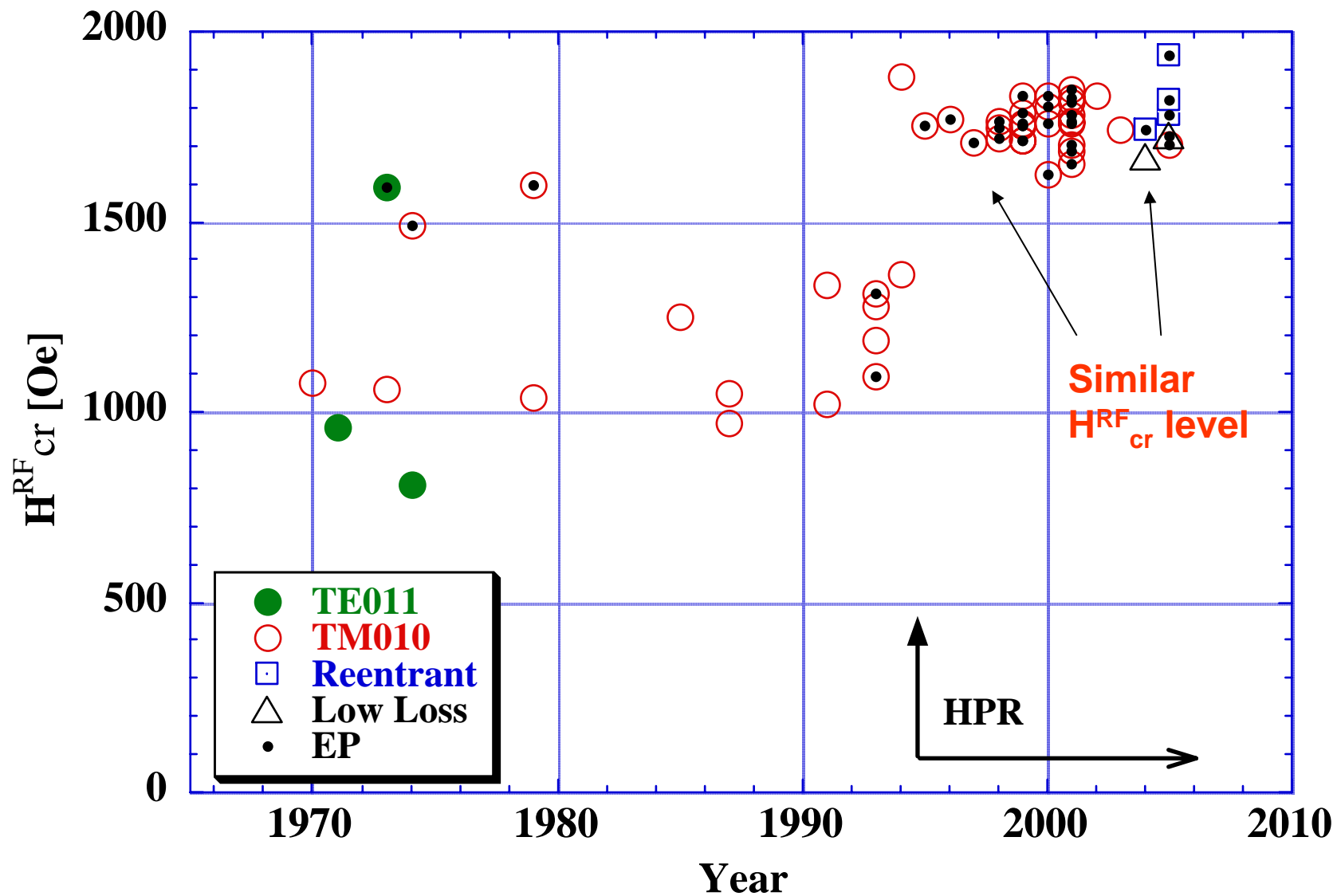
KEK preparation recipe: Mec. Grinding, light-CP(10um),
Anneal(750C), EP(80um), HPR,
Bake(48h,120C)

KEK preparation recipe is very reliable!

Eacc (max) vs. Year

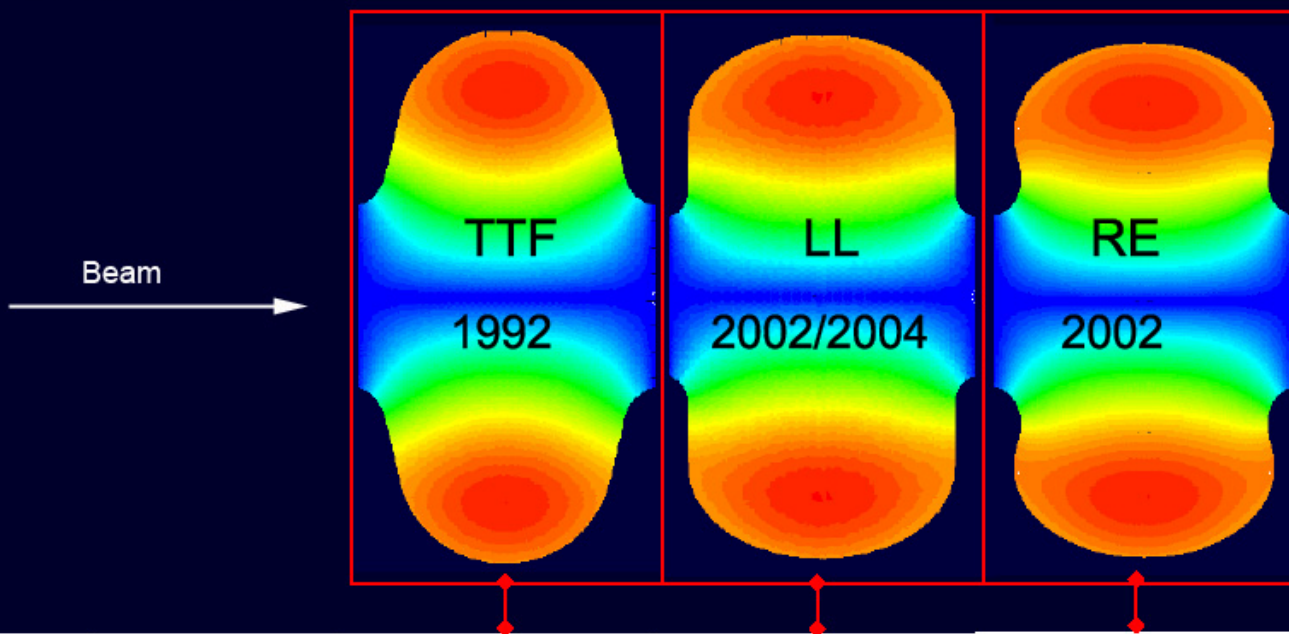


H_{cr}^{RF} vs Year



Cavity-shape designs with low $B_{\text{peak}}/E_{\text{acc}}$ made the breakthrough.

Example: 1.3 GHz inner cells for TESLA and ILC



r_{irisb}	[mm]	35	30	33	
k_{cc}	[%]	1.9	1.52	1.8	field flatness
$E_{\text{peak}}/E_{\text{acc}}$	-	1.98	2.36	2.21	max gradient (E limit)
$B_{\text{peak}}/E_{\text{acc}}$	[mT/(MV/m)]	4.15	3.61	3.76	max gradient (B limit)
R/Q	[Ω]	113.8	133.7	126.8	stored energy
G	[Ω]	271	284	277	dissipation
R/Q*G	[Ω^2]	30840	37970	35123	dissipation (Cryo limit)

Single-cell cavity study

- Priority: single-cell cavity study > 9-cell cavity study (for a while, 2 months?).
- Going to fabricate four ICHIRO single-cell cavities. (One was already fabricated.)
- Test the reproducibility of KEK preparation recipe by bunch of single-cell cavities, RE(1)/LL(2)/ICHIRO(4). (n)=# of cavities.
- Go back each step of recipe one by one.
=> Check the reproducibility.
- Do above checks with RE(1)/LL(2)/ICHIRO(4) cavities.
- Fill up the “Recipe step vs Cavity” matrix table (next slide). => Ensure the reproducibility of recipe.
- Then, move to 9-cell cavity study.

Processing	Reentrant	LL-No.1	LL-No.2	ICHIRO center cell
••• EP(30)+ HPR(UPW)+Bake	47.0/1.12E10 MP(20min)/FE(>35)	46.5/1.20E10 MP(45min)/FE(>35)		
Performance reproducibility (re-evacuated)	51.2/0.59E9 MP(10)/FE(>35)	47.3/1.13E10 MP(20)/FE(>35)		
HPR(UPW)+No bake	52.3/0.97E10 MP(15)/FE(>35)	33.9/0.32E10 FE(>17) Test again Oct.6		
Reproducibility (re-evacuated)	51.9/1.11E10 MP(3)/FE(40)	Oct. 12	by end of Oct.	by end of Oct.
Reproducibility (no evacuated)	52.4/1.21E10 MP(3)/FE(>35)	Oct. 7	by end o Oct.	by end of Oct.
HPR(PW @ KEK)	Oct. 11	by end of Oct.		
Light CP +HPR +Bake	by end of Oct.	by end of Oct.		
CBP+light CP+An(750) +EP(80)+HPR+Bake	<div></div>	<div></div>	Oct.18	Oct. 14
CBP+light CP+EP(80) +An(750)+CP(10) +HPR+Bake	<div></div>	<div></div>	<div></div>	<div></div>

1st ICHIRO 9-cell cavity

1st vertical measurement (27 July 2005)

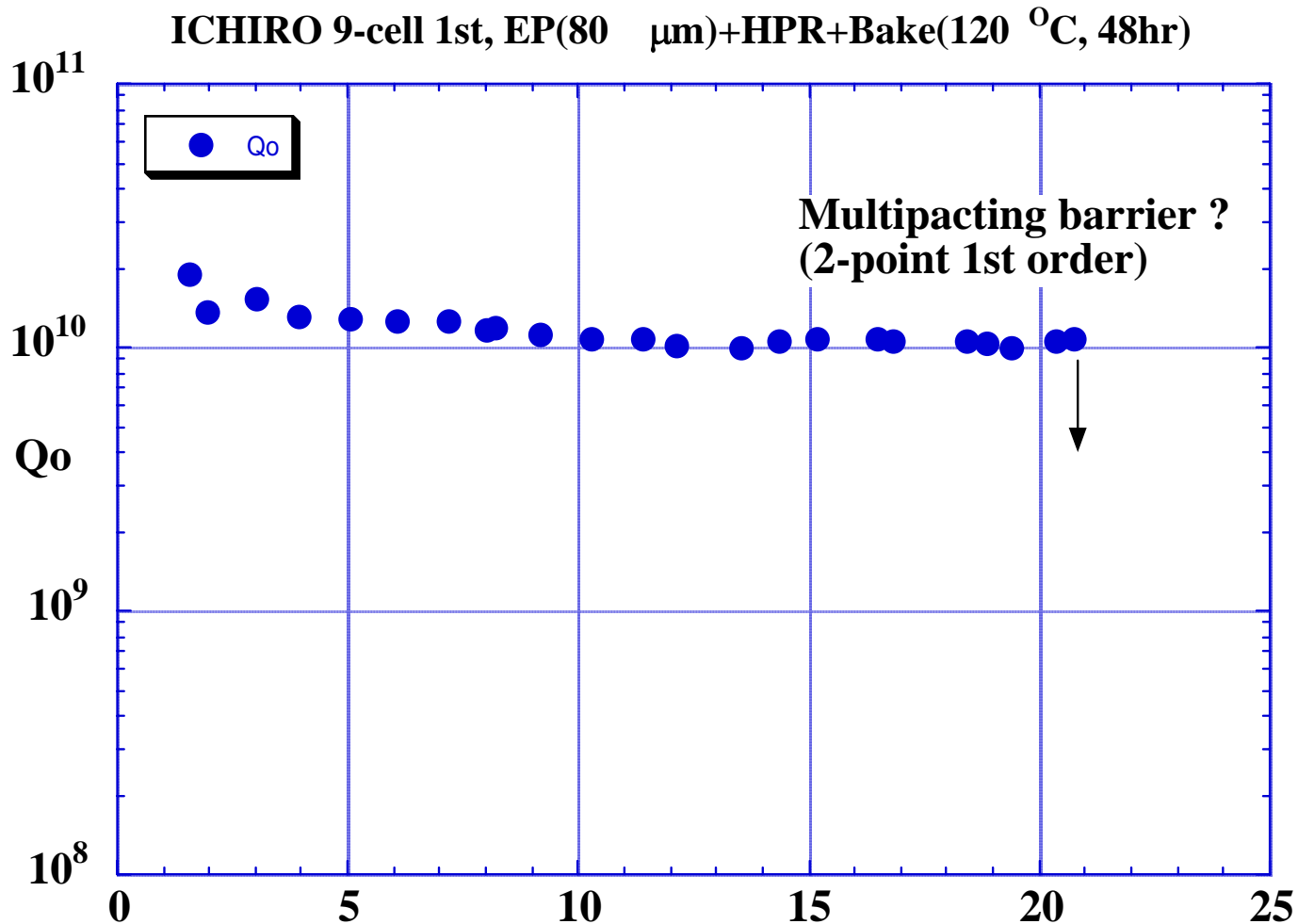


Fig.2: Vertical test result on ICHIRO 9-cell 1st cavity

The lower Q_0 value $\sim 1 \times 10^{10}$ (expected value 2×10^{10}) is due to heating at stainless flanges at both ends.

Four 9-cell ICHIRO (LL) cavities

- **1st ICHIRO**: waiting for next VT. Next month?
We concentrate on the VTs of single-cell RE/LL/ICHIRO cavities for a while.
- **2nd ICHIRO**: Mec.Grinding, CP, Anneal, Pre-tuning, EP, done.
=> Been used for high-gradient tuner test.
- **3rd ICHIRO**: Mec. Grinding, CP, Anneal, done. => Pre-tuning, EP will be done soon.
=> Will be sent to DESY. (end of Oct.?)
- **4th ICHIRO**: Mec. Grinding on going.
=> Will be used for HOM coupler test.

SUMMARY

- RE: Av.=51.2MV/m, Std.=1.8MV/m (5 VTs).
- LL: Av.=46.8MV/m, Std.=0.5MV/m (2 VTs).
- KEK Preparation recipe is reliable.
- Priority: Single-cell > 9-cell (for a while). Four single-cell ICHIRO cavities will be fabricated soon.
- The “Recipe step vs Cavity” matrix table would be filled up and ensure the KEK recipe.
- Four 9-cell ICHIRO cavities status.
1st: waiting for VT, 2nd: for tuner test,
3rd: to DESY (end of Oct?), 4th: for HOM test.